Amendments to the Claims:

Please cancel claims 2-8, amend claims 1, 9, 10 and 11, and add claims 12-32
as shown in the following listing of claims. This listing of claims will replace all
5   prior versions, and listings, of claims in the application.

1   1.   (currently amended) An omni-directional image and 3-Dimensional data
2   acquisition apparatus, comprising:
3   a plurality of multi-camera modules positioned along the direction of
4   height, each of the a-multi-camera module modules including multiple constructed in
5   a manner comprising a plurality of cameras that are symmetrically arranged with a
6   specific point in a plane such that the optical centers of the multiple cameras are in a
7   plane, the multiple cameras of the multi-camera modules being further arranged such
8   that the optical axis of at least one of the multiple cameras from a first multi-camera
9   module of the multi-camera modules at a first height is pointing in the same direction
10 as the optical axis of at least one of the multiple cameras from a second multi-camera
11 module of the multi-camera modules at a second height such that the optical axes are
12 parallel; and, each of the cameras taking charge of each of divided angles such that
13 the camera module can take an omni-directional continuous panoramic photograph of
14 surrounding objects with the specific point;
15   a vision computer system operatively connected to each of the multiple
16 cameras of the multi-camera modules, the vision computer system being configured
17 to process and store images acquired by the multiple cameras.
18   first frame grabbers each of which is electrically connected to each of
19 the cameras of the multi-camera module, to grab photographed images by frames;
20   an exposure calculator electrically connected to the first frame
21 grabbers, to calculate exposure of each camera, based on the grabbed images by
22 frames;

23   ~~an exposure signal generator electrically connected to each camera, to~~
24   ~~transmit information about the exposure as a signal on the basis of the exposure~~
25   ~~calculated by the exposure calculator;~~
26   ~~storage means electrically connected to the each first frame grabber, to~~
27   ~~store images photographed by the cameras according to photographing location and~~
28   ~~photographing time;~~
29   ~~a GPS sensor to sense the photographing location and photographing~~
30   ~~time;~~
31   ~~an annotation entering unit electrically connected to the GPS sensor to~~
32   ~~calculate location and time corresponding to each frame based on sensed data of the~~
33   ~~GPS sensor, the annotation entering unit being electrically connected to the storage~~
34   ~~means to enter the calculated location and time in each frame as annotation; and~~
35   ~~a trigger signal generator electrically connected the storage means, the~~
36   ~~exposure signal generator, the annotation entering unit, the trigger signal generator~~
37   ~~selectively transmits a trigger signal to the exposure signal generator or the annotation~~
38   ~~entering unit in order that the cameras start to photograph the objects according to the~~
39   ~~trigger signal; and wherein the multi-camera module are vertically stacked and~~
40   ~~formed in at least two layers in the direction of height.~~

1   2.   (canceled).

1   3.   (canceled).

1   4.   (canceled).

1   5.   (canceled).

1   6.   (canceled).

1   7.   (canceled).

1 8.   (canceled).

1 9.   (currently amended) A method for acquiring 3-dimensional data, the method

2 comprising the steps of:

3   acquiring first images using a multi-camera module comprising

4 multiple cameras, including using at least some of the multiple cameras with the

5 optical centers in a first plane at a first height to acquire the first images;

6   acquiring second images using the multi-camera module, including

7 using at least some of the multiple cameras with the optical centers in a second plane

8 at a second height to acquire the second images, the second plane being parallel to the

9 first plane;

10   searching for corresponding points in one of the first images and in

11 one of the second images each image;

12   extracting for distance information for the corresponding points using

13 trigonometry; and

14   acquiring for 3-dimensional data based on the distance information.

1 10.   (currently amended) A method for extending dynamic range of images,

2 comprising the steps of:

3   acquiring for multi multiple images of an object, the multi multiple

4 images being photographed by the cameras of a multi-camera module which have

5 different exposure amounts amount each other, wherein the cameras the multi camera

6 module comprising a plurality of cameras which are symmetrically arranged at a

7 specific point in a plane, and which take charge of each allocating viewing angle

8 calculated by 360° divided by the number of the cameras;

9   selectively extracting for regions in the multi multiple images, wherein

10 the regions are included within the dynamic range of the cameras camera; and

11   acquiring for images of dynamic range extension, which are generated

12 by composing the extracting regions.

1   11.   (currently amended) An omni-directional image and 3-Dimensional data

2   acquisition apparatus, comprising:

3   a multi-camera module including ~~constructed in a manner comprised~~

4   ~~of a plurality of~~ multiple cameras that are ~~symmetrically~~ arranged ~~with a specific~~

5   ~~point in a plane~~ such that the optical centers of the cameras are in a plane, ~~each of the~~

6   ~~cameras taking charge of each of divided angles such that the camera module can take~~

7   ~~an omni-directional continuous panoramic photograph of surrounding objects with~~

8   ~~the specific point;~~

9   an elevator for elevating the multi-camera module vertically; and

10   a vision computer system operatively connected to each of the multiple

11   cameras of the multi-camera modules, the vision computer system being configured

12   to process and store images acquired by the multiple cameras.

13   ~~first frame grabbers each of which is electrically connected to each of~~

14   ~~the cameras of the multi-camera module, to grab photographed images by frames;~~

15   ~~an exposure calculator electrically connected to the first frame~~

16   ~~grabbers, to calculate exposure of each camera, based on the grabbed images by~~

17   ~~frames;~~

18   ~~an exposure signal generator electrically connected to each camera, to~~

19   ~~transmit information about the exposure as a signal on the basis of the exposure~~

20   ~~calculated by the exposure calculator;~~

21   ~~storage means electrically connected to the each first frame grabber, to~~

22   ~~store images photographed by the cameras according to photographing location and~~

23   ~~photographing time;~~

24   ~~a GPS sensor to sense the photographing location and photographing~~

25   ~~time;~~

26   ~~an annotation entering unit electrically connected to the GPS sensor to~~

27   ~~calculate location and time corresponding to each frame based on sensed data of the~~

28   ~~GPS sensor, the annotation entering unit being electrically connected to the storage~~

29   ~~means to enter the calculated location and time in each frame as annotation; and~~

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30   ~~a trigger signal generator electrically connected the storage means, the~~
31   ~~exposure signal generator, the annotation entering unit, the trigger signal generator~~
32   ~~selectively transmits a trigger signal to the exposure signal generator or the annotation~~
33   ~~entering unit in order that the cameras start to photograph the objects according to the~~
34   ~~trigger signal.~~

1   12.   (new) The apparatus of claim 1, wherein the optical axes of the multiple
2   cameras of the first multi-camera module are in a first plane and the optical axes of
3   the multiple cameras of the second multi-camera module are in a second plane, the
4   first and second planes being parallel to each other and perpendicular to the direction
5   of height.

1   13.   (new) The apparatus of claim 1, wherein each of the optical centers of the
2   multiple cameras of the first multi-camera module is vertically aligned with one of
3   the optical centers of the multiple cameras of the second multi-camera module.

1   14.   (new) The apparatus of claim 13, wherein the optical axis of each of the
2   multiple cameras of the first multi-camera module is parallel to the optical axis of a
3   camera of the second multi-camera module that is vertically aligned with that
4   multiple camera of the first multi-camera module.

1   15.   (new) The apparatus of claim 13, wherein the optical axes of the multiple
2   cameras of the first multi-camera module are in a first plane and the optical axes of
3   the multiple cameras of the second multi-camera module are in a second plane, the
4   first and second planes being parallel to each other and perpendicular to the direction
5   of height.

1   16.   (new) The apparatus of claim 1, wherein the plurality of multi-camera module
2   includes a third multi-camera module at a third height.

1   17.   (new) The method of claim 9, further comprising elevating the multi-camera

2   module so that the optical centers of at least some of the cameras of the multi-camera

3   module are moved from the first plane to the second plane to capture the first and

4   second images.

1   18.   (new) The method of claim 17, wherein the acquiring the second images

2   includes acquiring the second images using cameras of the multi-camera module that

3   differ from cameras of the multi-camera module used to acquire the first images.

1   19.   (new) The method of claim 9, wherein each of the optical centers in the first

2   plane is vertically aligned with one of the optical centers in the second plane.

1   20.   (new) The method of claim 19, wherein the optical axis corresponding to each

2   of the optical centers in the first plane is parallel to the optical axis corresponding to

3   one of the optical centers in the second plane that is vertical aligned with that optical

4   center.

1   21.   (new) The method of claim 9, wherein the optical axes corresponding to the

2   optical centers in the first plane are parallel to the optical axes corresponding to the

3   optical centers in the second plane.

1   22.   (new) The method of claim 9, wherein the first plane and the second plane are

2   perpendicular to the direction of height.

1   23.   (new) The method of claim 9, further comprising acquiring third images using

2   the multi-camera module, including using at least some of the multiple cameras with

3   the optical centers in a third plane at a third height to acquire the third images.

1   24.   (new) The apparatus of claim 11, wherein the optical axes of the multiple

2   cameras of the multi-camera module are in the plane.

1   25.   (new) The apparatus of claim 11, wherein the multiple cameras of the multi-

2   camera module are symmetrically arranged about a center point in the plane.

1   26.   (new) A method for acquiring 3-dimensional data, the method comprising:

2   acquiring first images using a multi-camera module comprising

3   multiple cameras at a first location, the optical centers of the multiple cameras being

4   in a plane;

5   moving the multi-camera module from the first location to a second

6   location;

7   acquiring second images using the multi-camera module at the second

8   location;

9   searching corresponding points in at least one of the first images and in

10   at least one of the second images;

11   extracting distance information for the corresponding points using

12   trigonometry; and

13   acquiring 3-dimensional data based on the distance information.

1   27.   The method of claim 26 wherein moving the multi-camera module includes

2   moving the multi-camera module along a horizontal direction.

1   28.   The method of claim 26 wherein moving the multi-camera module includes

2   moving the multi-camera module along a vertical direction.

1   29.   The method of claim 26 further comprising acquiring additional first images

2   using additional cameras of the multi-camera module at the first location, the optical

3   centers of the additional cameras being a different height than the optical centers of

4   the multiple cameras, and wherein searching the corresponding points further

5   includes searching the corresponding points in at least one of the additional first

6   images.

1   30.   (new) An omni-directional image and 3-Dimensional data acquisition

2   apparatus, comprising:

3   a plurality of multi-camera modules, each multi-camera module

4   constructed in a manner comprising a plurality of cameras that are symmetrically

5   arranged with a specific point in a plane, each of the cameras taking charge of each of

6   divided angles such that each multi-camera module can take an omni-directional

7   continuous panoramic photograph of surrounding objects with the specific point;

8   first frame grabbers each of which is electrically connected to each of

9   the cameras of each multi-camera module, to grab photographed images by frames;

10   an exposure calculator electrically connected to the first frame

11   grabbers, to calculate exposure of each camera, based on the grabbed images by

12   frames;

13   an exposure signal generator electrically connected to each camera, to

14   transmit information about the exposure as a signal on the basis of the exposure

15   calculated by the exposure calculator;

16   a plurality of light intensity sensors electrically connected to the

17   exposure calculator to allow the exposure calculator to be able to calculate the

18   exposure amount of the each camera based on external light intensity;

19   storage means electrically connected to the each first frame grabber, to

20   store images photographed by the cameras according to photographing location and

21   photographing time;

22   a GPS sensor to sense the photographing location and photographing

23   time;

24   an annotation entering unit electrically connected to the GPS sensor to

25   calculate location and time corresponding to each frame based on sensed data of the

26   GPS sensor, the annotation entering unit being electrically connected to the storage

27   means to enter the calculated location and time in each frame as annotation; and

28   a trigger signal generator electrically connected the storage means, the

29   exposure signal generator, the annotation entering unit, the trigger signal generator

30   selectively transmits a trigger signal to the exposure signal generator or the annotation

31   entering unit in order that the cameras start to photograph the objects according to the

32   trigger signal; and wherein the multi-camera modules are vertically stacked and

33   formed in at least two layers in the direction of height.

1   31.   (new) An omni-directional image and 3-Dimensional data acquisition

2   apparatus, comprising:

3   a plurality of multi-camera modules, each multi-camera module

4   constructed in a manner comprising a plurality of cameras that are symmetrically

5   arranged with a specific point in a plane, each of the cameras taking charge of each of

6   divided angles such that each multi-camera module can take an omni-directional

7   continuous panoramic photograph of surrounding objects with the specific point;

8   first frame grabbers each of which is electrically connected to each of

9   the cameras of each multi-camera module, to grab photographed images by frames;

10   an exposure calculator electrically connected to the first frame

11   grabbers, to calculate exposure of each camera, based on the grabbed images by

12   frames;

13   an exposure signal generator electrically connected to each camera, to

14   transmit information about the exposure as a signal on the basis of the exposure

15   calculated by the exposure calculator;

16   storage means electrically connected to the each first frame grabber, to

17   store images photographed by the cameras according to photographing location and

18   photographing time;

19   a video camera electrically connected to the storage means via a

20   second frame grabber for grabbing photographed moving pictures by frames, to the

21   storage means a unique video clip corresponding to each image or image group to be

22   stored in the storage means;

23   a GPS sensor to sense the photographing location and photographing

24   time;

25   an annotation entering unit electrically connected to the GPS sensor to

26   calculate location and time corresponding to each frame based on sensed data of the

27   GPS sensor, the annotation entering unit being electrically connected to the storage

28   means to enter the calculated location and time in each frame as annotation; and

29   a trigger signal generator electrically connected the storage means, the

30   exposure signal generator, the annotation entering unit, the trigger signal generator

31   selectively transmits a trigger signal to the exposure signal generator or the annotation

32   entering unit in order that the cameras start to photograph the objects according to the

33   trigger signal; and wherein the multi-camera modules are vertically stacked and

34   formed in at least two layers in the direction of height.

1   32.   (new) An omni-directional image and 3-Dimensional data acquisition

2   apparatus, comprising:

3   a plurality of multi-camera modules, each multi-camera module

4   constructed in a manner comprising a plurality of cameras that are symmetrically

5   arranged with a specific point in a plane, each of the cameras taking charge of each of

6   divided angles such that each multi-camera module can take an omni-directional

7   continuous panoramic photograph of surrounding objects with the specific point;

8   first frame grabbers each of which is electrically connected to each of

9   the cameras of each multi-camera module, to grab photographed images by frames;

10   an exposure calculator electrically connected to the first frame

11   grabbers, to calculate exposure of each camera, based on the grabbed images by

12   frames;

13   an exposure signal generator electrically connected to each camera, to

14   transmit information about the exposure as a signal on the basis of the exposure

15   calculated by the exposure calculator;

16   storage means electrically connected to the each first frame grabber, to

17   store images photographed by the cameras according to photographing location and

18   photographing time;

19   a distance sensor and a direction sensor for respectively sensing the

20   distance and direction of the image photographed by each camera;

21   a GPS sensor to sense the photographing location and photographing

22   time;

23   an annotation entering unit electrically connected to the GPS sensor to

24   calculate location and time corresponding to each frame based on sensed data of the

25   GPS sensor, the annotation entering unit being electrically connected to the storage

26   means to enter the calculated location and time in each frame as annotation; and

27   a trigger signal generator electrically connected the storage means, the

28   exposure signal generator, the annotation entering unit, the trigger signal generator

29   selectively transmits a trigger signal to the exposure signal generator or the annotation

30   entering unit in order that the cameras start to photograph the objects according to the

31   trigger signal; and wherein the multi-camera modules are vertically stacked and

32   formed in at least two layers in the direction of height.

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